High Efficiency Three Phase Resonant Conversion for Standardized Architecture Power System Applications, Phase II

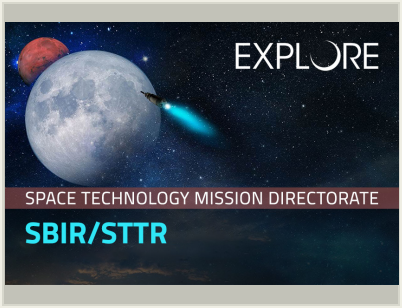
Completed Technology Project (2006 - 2010)

Project Introduction

A low-cost, standardized-architecture power system is proposed for NASA electric propulsion (EP) applications. Three approaches are combined to develop a system that will meet current and future NASA needs and exceed currently available power processor unit (PPU) performance in terms of electrical efficiency, specific mass (kg/kW), and cost. The approaches include the use of (a) high-efficiency, 3-phase, dc-dc converters to minimize cooling requirements, mass, and parts count and maximize reliability and efficiency, (b) modularized and standardized sub-system design and fabrication techniques to accommodate power output scaling and re-configuration for specific ion thruster designs without the need to re-qualify hardware, and (c) attention to cost and manufacturability issues that will allow the implementation of electric propulsion systems on future NASA missions without the hidden costs of "hard-to-build" and "hard-to-scale" designs that are currently available.

Anticipated Benefits

Potential NASA Commercial Applications: Non-NASA uses for the proposed idea are commercial high power applications where low cost and high efficiency are desired. Again the same advantages apply here. The most notable being the wide utility and range. The LCC circuit gives the 3PRC a naturally wide load range of two to one for voltage; double the range of the best competing design. The three-phase circuitry requires only the most minute input and output filter giving this topology very low mass. Motor-drive power processors - Electric Vehicles A wide DC power range maximizes the power range for both the motor and the motor's inverter over a wide span of angular velocities. This wide and efficient range reduces the number of transmission shift cycles needed for rapid acceleration. Green power - Solar Power Processors CPE has designed 3PRC with efficiencies as high as 98%



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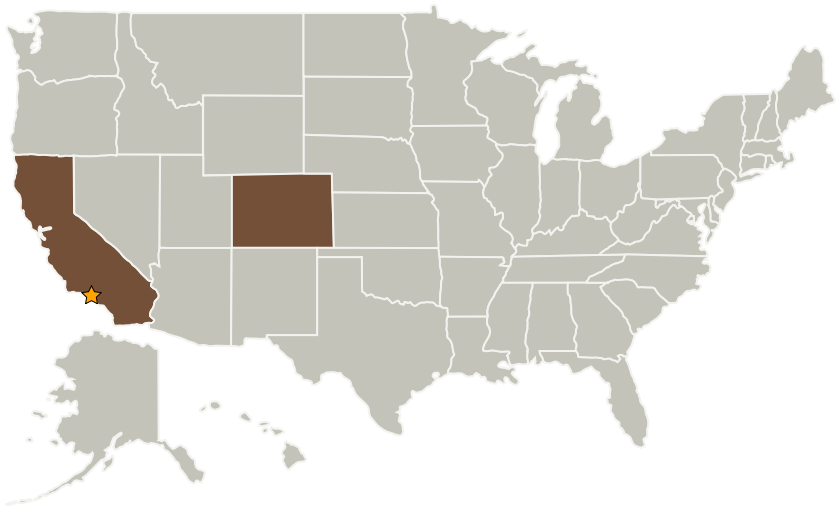
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Colorado Power Electronics, Inc.	Supporting Organization	Industry Veteran-Owned Small Business (VOSB)	Fort Collins, Colorado

Primary U.S. Work Locations	
California	Colorado

Project Transitions

December 2006: Project Start

January 2010: Closed out

Closeout Summary: High Efficiency Three Phase Resonant Conversion for Standardized Architecture Power System Applications, Phase II Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

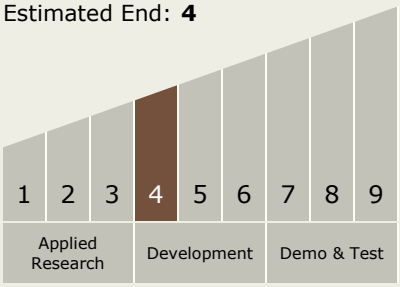
Carlos Torrez

Principal Investigator:

Geoffrey N Drummond

Technology Maturity (TRL)

Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.3 Electrical Power Conversion and Regulation